

REMARKSRegarding the Status of the Claims:

Claims 1, 3, 5 - 8, 10, and 13 – 23 are pending.

Claims 2, 4, 9 and 11-12 are canceled.

Claims 18 – 23 have been withdrawn from consideration. However, these method claims depend from Claim 1 so rejoinder is requested if Claim 1 is allowed.

Regarding the Claim Amendments presented in this reply:

The amendments to the claims do not add new matter.

- Claims 1, 12 and the intervening dependent claims 9 and 11 have been combined into Claim 1.
- Claim 10 is amended to depend from Claim 1.
- Claim 13 has been amended in response to the objection under 37 C.F.R. §1.75(c).

Regarding the Objections to the Claims:

The objection to Claim 13 under 37 C.F.R. §1.75(c), as being in improper dependent form is moot in light of the amendment to Claim 13.

Regarding the Claim Rejections:

The Office action rejects:

- I. Claims 1, 3, 5 – 12, 16, and 17 under 35 U.S.C §103(a) over US 5,662,860 to Klaassen et al. (hereinafter, “Klaassen”) and US 5,769,9823 to Nishikawa et al. (hereinafter, “Nishikawa”); and
- II. Claims 13 – 15 under 35 U.S.C §103(a) over Klaassen, Nishikawa, and US 5,733,358 to Geiger et al. (hereinafter, “Geiger”).

Regarding Rejection I:

Applicants respectfully submit the rejection of claims 1, 3, 5 – 12, 16, and 17 under 35 U.S.C. §103(a) over Klaassen and Nishikawa should be withdrawn.

Applicants respectfully assert Klaassen does not recognize the need to arrange the lances to produce a flow of the post-combusted gases through the center of the vessel versus the side walls cooled with water pipes, and the secondary references do not make up for this shortcoming.

The metallurgical vessel according to Claim 1

Claim 1 is a combination of Claims 1, 9, 11 and 12.

Against Claim 9 the Office action asserts since the feed chute of Klaassen et al. is positioned in the downward direction, it would be capable of directing the material in the same manner.

Claim 9 (now Claim 1) recites feed chutes for adding particulate material to the vessel in the substantially downwardly directed flow of post-combusted gases. Klaassen et al. cannot do this. Klaassen et al. locates the feed chute 22 entry in the upper portion of the vessel such that particulate material is fed to the vessel where gas flows upwardly.

In regard to claim 12 (now Claim 1), the Office action asserts Klaassen et al. teaches the vessel of claim 11 wherein each feed chute is positioned between the lance and the sidewall of the metallurgical vessel. Klaassen et al. does not disclose the positioning of the feed chute and the lance in a radial direction, but Klaassen et al. is said to teach positioning of the feed chute in the substantially downward flow of the post-combusted gas. Thus, the Office action asserts the positioning shown by Klaassen et al. is the functional equivalent of that recited by Claim 12. In other words, it performs the same function as the feed chute in Claim 12. Therefore it would be obvious to one skilled in the art to position the feed chute between the lance and the sidewall in a radial direction after routine experimentation to optimize the position.

Amended Claim 1 (essentially former Claim 12 in independent form) recites the feed chute is positioned between a lance and the sidewall of the metallurgical vessel in a radial direction. The location of a chute in a radial direction with respect of a lance is not disclosed in Klaassen. Klaassen shows coal being supplied by means of chute 22, which

is not positioned between a lance and the sidewall of the metallurgical vessel in a radial direction.

Klaassen positions the coal feed chute 22 to downwardly feed coal into the substantially upward flow of the post-combusted gas. Also, the feed chute discharge opening is at a completely different location than in the present invention. Klaassen locates the discharge opening of coal feed chute 22 above the lances to feed and drop into the foam. As such, material fed to the vessel by means of the Klaassen chute 22 may be blown out of the vessel, because of the position of the chute 22 in the upward flow of gases.

Present Figures 3 and 4 illustrate simulations of the difference between the position of a chute according to the present invention, and the position of the chute according to Klaassen. As stated on page 8, lines 27 – 31 of the specification,

"Figure 2 shows a section of the vessel 1, a lance 3 projecting into the section of the vessel and the trajectories 15 of coal particles added to the vessel. The advantage obtained by adding coal particles a short distance from the lances is clear as the particles are entrained towards the slag layer with the substantially downward flow of post-combusted gases at the sidewall of the vessel."

In contrast, as illustrated in Figure 4 and explained at page 8, lines 31 – 34 of the present specification, when the chute is positioned between the lances, as in Klaassen, "the majority of the particles are entrained in the upwardly directed flow of post-combusted gases in the centre of the vessel and leave the vessel." Thus, contrary to the assertion on page 6, line 20 – page 7, line 2 of the Office action, applicants respectfully submit the position of chute 22 is not a functional equivalent of the position of the chute in the presently claimed metallurgical vessel.

Nishikawa is not cited to compensate for these shortcomings. Thus, Claim 1 is not obvious over Klaassen and Nishikawa. Since Claims 3, 5 – 12, 16 and 17 depend from Claim 1, they are also nonobvious over Klaassen and Nishikawa.

The metallurgical vessel according to Claim 6

Claim 6 further distinguishes over the references. Claim 6 recites at least one of the lances project through a roof portion of the metallurgical vessel; and at least one of

the lances to be inclined from the vertical under a first acute angle with its end portion inclined towards the central axis of the metallurgical vessel; and the end portion of the lance to be configured to direct the oxygen containing gas towards the central axis of the metallurgical vessel under a second acute angle from the vertical which second acute angle is greater than the first acute angle. The Office action asserts the lances of Klaassen could be angled to meet Claim 6, because Klaassen et al., col. 3, lines 54 – 59 states, “[i]n principle, the part 20 with an enlarged cross-section makes it possible to position the lances more vertically.” However, at Col. 2, lines 36 – 46, Klaassen explains the lances are oriented as much as possible vertically, thereby achieving the effect that the supply of oxygen to the metallurgical vessel still takes place as much as possible in the same place above the slag layer as the level of slag varies. Klaassen goes to the effort to modify its apparatus to increase the vertical orientation of its lances. Thus, it would not be obvious to undo this effort by discharging from the lances at an acute angle further away from vertical than the lances.

In a metallurgical vessel, as claimed in claim 6, with the lances in a two part configuration at different angles, it has been unexpectedly discovered that it is possible to have the lances enter the vessel at the roof portion of the vessel and to direct the oxygen at the correct angle with respect to the vertical axis of the vessel, while at the same time keeping the lances out of the central part of the vessel. This is an important feature, because of the pre-reduced iron oxide 40 falling down from the melting cyclone 38 into the vessel 31. As explained at page 9, lines 33 – 37 of the specification,

[t]he reducing process gas rises and is further post-combusted in the melting cyclone 38 with oxygen containing gas supplied to the melting cyclone. Iron oxide supplied to the melting cyclone is pre-reduced approximately to FeO and at least partly melted in the melting cyclone. The pre-reduced iron oxide 40 then falls or flows down into the metallurgical vessel 31.

Positioning the lances to enter the vessel through the roof portion ensures enough space between the lances and the sidewall of the vessel for the feed chutes 12. In this position of the feed chute is located for feeding all particles to the slag and/or molten

metal and to prevent the particles from entering the central flow of gases and being blown out directly. Nishikawa is not cited to compensate for these shortcomings. For at least these reasons, Claim 6 is nonobvious of Klaassen and Nishikawa.

The metallurgical vessel according to Claim 8

Claim 8 further distinguishes over the references. Claim 8 recites at least one of the lances to be adjustable in height. The Office action cites Col. 3, lines 52 – 62 of Klaassen, which states, “[i]n principle, the part 20 with an enlarged cross-section makes it possible to position the lances 23 more vertically.” The Office action asserts this statement is a disclosure of lances adjustable in height.

Page 3, lines 30 – 33 of the present application explains the lances may be adjustable in height and therefore able to be positioned at an optimal height over the surface of the of the vessel contents when the vessel is at varying levels of fullness. In other words, the lances of a given vessel can be moved to different heights. In contrast, for a given vessel the Klaassen lances have a fixed height. This is implied by Col. 2, lines 36 – 46 of Klaassen, which states the lances are oriented as much as possible vertically thereby achieving the effect that the supply of oxygen to the metallurgical vessel still takes place as much as possible in the same place above the slag layer as the level of slag varies. If the lances were adjustable this would not be necessary. Nishikawa is not cited to compensate for these shortcomings. For at least these reasons, claim 8 is nonobvious of Klaassen and Nishikawa.

Regarding Rejection II:

Applicants respectfully submit the rejection of Claims 13 – 15 under 35 U.S.C §103(a) over Klaassen, Nishikawa, and Geiger should be withdrawn. Claim 13 has been amended to recite the tuyeres comprise oxy-fuel burners.

Klaassen does not recognize the need to arrange the lances to produce a flow of the post-combusted gases through the center of the vessel versus the side walls cooled with water pipes, and the secondary references do not make up for this shortcoming.

Additionally, against Claim 15 the Office action asserts the tuyeres 17 of Geiger would be capable of burning oxy-fuel, because FIG. 5 of Geiger comprises a burner (19) that can burn natural gas and a natural gas/oxygen burner (12).

This assertion is respectfully traversed. The tuyeres 17 of Geiger are separate from burners 12, 19 of Geiger. Thus, tuyeres 17 of Geiger do not have oxy-fuel burners and are not capable of burning oxy-fuel. The secondary references do not make up for this.

In Conclusion:

The present application is in condition for allowance. Applicants request favorable action in this matter. In order to facilitate the resolution of any issues or questions presented by this paper, the Examiner is welcome to contact the undersigned by phone to further the discussion.

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